

## CHAPTER 5 FUEL ADJUSTMENT CLAUSE AUDIT AND REVIEW PROGRAM

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### 500 FUEL ADJUSTMENT CLAUSE COMPUTATION STATEMENT

- 500.1 The Potomac Electric Power Company (PEPCO) shall, prior to the pass-through of monthly fuel costs or monthly changes in fuel costs through any Fuel Adjustment Clause (FAC), prepare and file with the Public Service Commission (Commission) a standardized fuel adjustment clause computation statement.
- 500.2 This statement shall provide any information which the staff shall determine is needed for it to adequately verify the accuracy of the calculations supporting the monthly adjustment.
- 500.3 This statement shall be submitted to the Commission not less than five (5) business days prior to the date requested for the application of the current month's fuel adjustment charge to customers' bills.
- 500.4 After completing its arithmetic check, staff shall submit, not less than two (2) business days prior to the date requested for the application of the current month's fuel adjustment charge to customers' bills, a written statement to the Commission for its review verifying the accuracy of the numerical computations on a provisional basis, subject to further review and audit.

- 500.5 Upon completion of Commission review, the computation statement and the staff's verification shall be made available for public inspection at the Commission's offices.

**AUTHORITY:** Unless otherwise noted, the authority for this chapter is Paragraph 97(b) of §8 of An Act Making appropriations to provide for the expenses of the District of Columbia for the fiscal year ending June thirtieth, nineteen hundred and fourteen, and for other purposes, approved March 4, 1913 (37 *Stat.* 977); as amended by §2 of the Public Utilities Amendment Act of 1989, D.C. Law 8-47, D.C. Code §43-501 (1981 Ed.).

**SOURCE:** Final Rulemaking published at 29 DCR 5130 (November 19, 1982).

## **501 SEMI-ANNUAL ACCOUNT AUDIT OF FUEL TRANSACTIONS**

- 501.1 The Commission's auditors shall conduct a semi-annual audit of PEPCO's accounts to determine the accuracy of billed fuel cost adjustments.
- 501.2 The auditors shall implement an audit program that reflects current conditions to verify the proper recording of fuel transactions and to determine the propriety of the account treatment of purchased power and interchange transactions.
- 501.3 Staff shall report its findings in writing to the Commission, identifying any billing errors made during the review period.
- 501.4 Upon completion of the Commission review, the staff's audit report shall be made available for public inspection at the Commission's offices.

**SOURCE:** Final Rulemaking published at 29 DCR 5130, 5131 (November 19, 1982); as amended by Final Rulemaking published at 34 DCR 4088 (June 26, 1987).

## **502 STAFF REVIEW AND PUBLIC SCRUTINY OF FUEL PURCHASE AND GENERATING SYSTEM OPERATING PERFORMANCE**

- 502.1 The Commission staff shall develop over a two (2) year period a comprehensive program enabling it and the public to closely monitor and evaluate the company's fuel purchase and generating system operating performance.
- 502.2 The components of the program shall include the following:
- (a) Establishment of comprehensive fuel information reporting requirements;
  - (b) The development of staff capability to effectively monitor and evaluate PEPCO's performance in areas impacting on costs which are reflected in its fuel adjustment clause; and
  - (c) The review, evaluation and monitoring of a productivity improvement program to be developed and proposed by PEPCO and evaluated by the Commission.
- 502.3 This program shall be developed over a two (2) year period as set forth in §§505 through 520.

- 502.4 Contract - specific information related to the purchase of fuels which is filled with the Commission under this chapter shall be held confidential for the use of the Commission.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5131 (November 19, 1982).

**503 - 504 [RESERVED]**

**505 REPORTING REQUIREMENTS: GENERAL PROVISIONS**

- 505.1 The Commission's first step toward developing an effective monitoring program shall be to develop a centralized and comprehensive fuel information retrieval and processing system.
- 505.2 Sufficient data shall be collected to enable the staff and the public to continuously and intensively monitor and evaluate PEPCO's current and projected operating performance.
- 505.3 Pursuant to §505.2, the company shall, on a timely basis, make available to the staff extensive fuel and processing data information. The company shall also make available to the public certain parts of this data.
- 505.4 The data required under this chapter shall fall in the following categories;
- (a) Fuel adjustment calculation data support;
  - (b) Fuel procurement reporting requirements;
  - (c) Fuel consumption reporting requirements;
  - (d) Power system generating performance reporting requirements;
  - (e) Interchange activity reporting requirements; and
  - (f) Annual projections of fuel prices, consumption, expenditures, and generating system operating performance indices.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5131 (November 19, 1982).

**506 FUEL ADJUSTMENT CALCULATION DATA SUPPORT**

- 506.1 The company shall file monthly, at the time it requests a change to the previous month's fuel adjustment factor, a fuel adjustment clause computation statement containing information determined by the staff to be the minimal amount needed



to properly conduct an adequate monthly arithmetic check of the fuel adjustment charge.

506.2 Data collection shall be standardized, and reporting forms shall be developed on which the company shall provide specific categorized data items supporting the monthly fuel cost adjustment calculation.

506.3 Data shall include all information reasonably necessary to verify the arithmetic accuracy of the monthly fuel rate computation including the computation of the various adjustment factors.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5132 (November 19, 1982).

## **507 FUEL PROCUREMENT REPORTING REQUIREMENTS**

507.1 The company shall, on the prescribed forms, file monthly with the Commission a "Monthly Report on Costs and Quality of Fuels Delivered to Electric Plants" and a "Monthly Fuel Price Summary Date Report."

507.2 The Monthly Report on Costs and Quality of Fuels Delivered to Electric Plants shall contain the following information with respect to each plant:

- (a) Type of plant (steam or gas turbine);
- (b) Type of purchase (contract or spot);
- (c) Contract expiration within twenty-four (24) months (Yes or No);
- (d) Fuel type (#2 oil, #6 oil, bituminous coal, etc.);
- (e) Coal mines (Type and District);
- (f) Source (county or area where coal originated; and for oil, refinery or port of entry, etc.);
- (g) Quantify received (M gallons, M tons, etc.);
- (h) Quality received;
  - average BTU content
  - % sulfur content
  - % ash content
- (i) Cost in ¢/million BTU (delivered);
- (j) Cost of fuel FOB (free on board) Source and transportation charges, stated separately for each fuel delivery; and

## (k) Premiums and Penalties.

- Source
- Company Plant
- Month(s)
- Tons (Gallons)
- Premiums (+), Penalties (-)
- Adjusted  $\phi$ MMBTU

507.3 The Monthly Fuel Price Summary Report shall contain the following information by plant type and fuel quality:

- (a) Fuel type (coal or oil);
- (b) Cost and quality per sulfur content range of fuels delivered (cent /MMBTU) (Steam Generation); and
  - .51% to 1.00%
  - 1.01% to 1.5% (coal)
  - 1.01% to 2.0% (oil)
  - 1.51% to 2.0% (coal)
  - 2.01% to 3.0% (oil)
- (c) Average contract and spot price of fuels delivered (Turbine and Combustion).

507.4 In addition to the reporting requirements of §§507.2 and 507.3, the company shall regularly file with the Commission a copy of each of its intermediate and long-term fuel supply contracts within ninety (90) days following their execution. In complying with this requirement, the company may identify contract data by code.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5132 (November 19, 1982).

## 508 FUEL CONSUMPTION REPORTING REQUIREMENTS

508.1 The company shall, on the prescribed form, file monthly with the Commission a "Monthly Report on Cost of Fuels Consumed by Electric Plants."

508.2 This report shall contain the following data for each generating plant:

- (a) Plant name;
- (b) Location;
- (c) Plant type;
- (d) Fuel type;
- (e) Quantity of fuel consumed;

- (f) Total fuel cost;
- (g) Average BTU content;
- (h) Fuel cost in cent per million BTU consumed; and
- (i) Generation (MWH) .

SOURCE: Final Rulemaking published at 29 DCR 5130, 5133 (November 19, 1982).

## **509 INTERCHANGE ACTIVITY REPORTING REQUIREMENTS**

- 509.1 The company shall, on the prescribed form, file monthly with the Commission an "Interchange Report."
- 509.2 The report shall contain the following information for the most recent month for which this data is available and the same month one (1) year earlier, and totals for each data item over the previous twelve (12) months:
- (a) Charges for energy received;
  - (b) Credits for energy delivered;
  - (c) Other charges;
  - (d) Total charges to PEPCO;
  - (e) Other credits;
  - (f) Total credits to PEPCO;
  - (g) Facilities Agreements;
  - (h) Net interchange;
  - (i) KWH energy received;
  - (j) KWH energy delivered;
  - (k) Net KWH interchange; and
  - (l) Interchange energy delivered by generating stations.
- 509.3 The company shall state (on a separate sheet, if necessary) the basis upon which it determines the cost of fuel for energy and capacity delivered into or received from transactions in interchange.
- 509.4 The company shall also include in the report or state separately the following:
- (a) Information on the timing of interchange purchases (date, hour(s), and duration);



- (b) Identify the capacity purchased and associated charges; and
- (c) Identify the energy purchased and associated charges.

509.5 The company shall append to the report specified under §509.1, a statement setting forth the running rate for the Pennsylvania, New Jersey, and Maryland (PJM) Interconnection. The company shall also provide its marginal cost of energy on an hourly basis for the period covered by the report.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5134 (November 19, 1982).

## 510 POWER SYSTEM GENERATING PERFORMANCE REPORTING REQUIREMENTS

510.1 The company shall, on the prescribed form, file semiannually with the Commission a report which contains the most current semiannually values of the following power plant performance indices for each generating unit and for the PEPCO system on a system-wide average basis. (See Appendix 5-1 for definitions):

- (a) Operating availability factor;
- (b) Equivalent availability factor;
- (c) Capacity factor;
- (d) Heat rate;
- (e) Forced outage rate;
- (f) Equivalent forced outage rate;
- (g) Planned outage rate; and
- (h) Maintenance outage rate;

510.2 PEPCO shall also provide additional information to the Commission on scheduled, maintenance and forced outages. For each full outage of twelve (12) hours or longer involving units of one hundred (100) MW or greater capacity, and each partial outage in units of one hundred (100) MW or greater which exceed five percent (5%) of net summer unit capacity, the date, type, cause, duration, MW on outage, and corrective action(s) shall be reported semiannually on forms prescribed by the Commission.

510.3 The total man-hours spent and total cost of outages (including the estimated cost of replacement power) shall also be reported for each month, on forms prescribed by the Commission.

510.4 In the event of a full, unplanned outage of five (5) or more days in duration of any stream electric generating station, PEPCO shall inform the Director of the Commission's Office of Engineering by telephone of the outage before the sixth (6th) day of such an outage.

- 510.5 PEPCO shall submit before the tenth (10th) day after the occurrence of any outage described in §510.4 a written report to the Director of the Commission's Office of Engineering consisting of a statement of the probable cause of the outage and either the date the station returned to service or the anticipated date the station will return to service.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5135 (November 19, 1982); as amended by Final Rulemaking published at 34 DCR 1568 (March 6, 1987); and by Final Rulemaking published at 34 DCR 1089 (June 26, 1987).

## 511 ANNUAL PROJECTIONS

- 511.1 The company shall submit to the Commission on February 15th of each year a forecast of fuel costs, power plant operating parameters, and its planned maintenance budget and timetable for each month of the forecast year.
- 511.2 Forecasts shall be developed for each generating unit and for PEPCO's entire generating system of the following generating system operating performance indices:
- (a) Operating availability factor;
  - (b) Equivalent availability factor;
  - (c) Capacity factor;
  - (d) Heat rate;
  - (e) Forced outage rate;
  - (f) Equivalent forced outage rate;
  - (g) Planned outage rate; and
  - (h) Maintenance outage rate.
- 511.3 Forecasts shall be made of fuel prices, consumption and expenditures by fuel type and quality for each generating plant and for the total PEPCO system, and of the company's planned maintenance budget and timetable.
- 511.4 All forecasts shall be accompanied by upper and lower limit forecast bounds (i.e., a forecast band). The range of this band shall reflect the potential variations from forecast values which may result from unanticipated but reasonable divergencies from expected performance under normal operating conditions.
- 511.5 Prior to the development of the forecasts, PEPCO shall submit a forecast procedure explaining its preferred methodology for computing forecast values.
- 511.6 Staff shall review this approach and the specific forecast method that the company follows. The forecasts are not to be strictly historically based; they should incorporate expected improvements in operating performance over the forecast period.



SOURCE: Final Rulemaking published at 29 DCR 5130, 5135 (November 19, 1982); as amended by Final Rulemaking published at 34 DCR 1568, 1569 (March 6, 1987).

## **512 MONITOR AND EVALUATION**

- 512.1 The staff of the Commission shall synthesize and evaluate the information required by this chapter to determine the reasons for changes in levels, fluctuations, and trends in specific plant and system operating parameters and expenditures.
- 512.2 This evaluation process shall include on-site inspections of company generating facilities, and discussions with PEPCO fuel procurement, planning and operating personnel on fuel data availability, potential areas for productivity improvements and statistical procedures used in forecasting fuel costs, interchange activity and plant operating performance parameters.
- 512.3 The staff shall report to the Commission on the feasibility and cost-effectiveness of computerizing some parts of the audit and review program.
- 512.4 The feasibility of computerizing fuel information reports shall be assessed (computerization would require computer-compatible formatting or reporting forms) and alternative computer programs shall be examined to determine which one(s) may better assist the staff in audit and review activities.
- 512.5 A decision shall then be made on the manner and extent of computer processing which is appropriate for the staff's monitoring activities.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5136 (November 19, 1982).

## **513 FORMULATION OF A PRODUCTIVITY IMPROVEMENT PROGRAM**

- 513.1 PEPCO shall develop and submit to the Commission annually on February 15th a proposed Productivity Improvement Plan (PIP) for the calendar year which sets cost-effective productivity improvement goals for the company to attempt to achieve by the end of that year.
- 513.2 The company's proposed plan shall identify those operating factors and practices contributing to productivity loss; assess the feasibility of taking specific cost-alternative productivity improvement measures; and propose those productivity improvement measures which will yield net benefits to District rate-payers (i.e., cost-effectiveness, or the net benefit-cost determination, is to be based on a total net incremental revenue requirement effect, either over the short or long run, depending on the specific productivity improvement under consideration).
- 513.3 The company's plan shall also include estimates of the capital and operating costs necessary to achieve productivity improvements, estimate the cost savings anticipated for productivity improvements, and identify the company's plans for decreased use of scarce fuels and effective preventive and outage maintenance (both short- and long-term).

513.4 The company's plan shall include historical statistics for the past ten (10) years by unit for PEPCO, and aggregated by size and type of unit for the Pennsylvania-New Jersey-Maryland (PJM) interconnection and for the North American Electric Reliability Council (NERC), and shall include a forecast for the current year for PEPCO, of the following information:

- (a) Total production expense (cents per kWh);
  - (1) Fuel and purchased power (cents per kWh);
  - (2) Salaries (cents per kWh);
  - (3) Other operations and maintenance (cents per kWh);
- (b) Power plant productivity;
  - (1) Heat rate (BTU kWh);
  - (2) Availability (percent);
  - (3) Equivalent availability factor (percent);
  - (4) Equivalent forced outage factor (percent);
  - (5) Capacity factor (percent);
- (c) Fuel procurement effectiveness (cents per MBTU as burned);
  - (1) Coal;
  - (2) Heavy oil;
  - (3) No. 2 fuel oil;
  - (4) Natural gas;

513.5 At an early stage in the company's development of its proposed productivity improvement plan, it is to establish a Productivity Improvement Working Group (PIWG) consisting of PEPCO technical staff representatives, the People's Counsel, and three (3) members of the Commission staff; one each from the Accounting, Economics and Engineering Division.

513.6 The primary purpose of the PIWG shall be to provide a mechanism through which Commission staff and the People's Counsel can communicate with the company while the PIP is in the developmental stage. However, the PIWG shall not formulate the PIP.

513.7 The group shall review and discuss the results of company productivity investigations and possible areas for productivity improvement. In addition, the group shall transfer technical knowledge to the staff which will ultimately assist in the Commission's review and evaluation of the company's productivity



improvement proposals, and thereby provide a sound technical knowledge foundation for an effective monitoring of the PIP.

513.8 The public shall have forty-five (45) days from the date of its submission to the Commission to comment on the company's proposed PIP.

513.9 The staff shall review the proposed PIP and by May 1st shall submit a report to the Commission summarizing and evaluating the comments of public parties, and providing its recommendations as to the proposed PIP. The staff's report shall also contain, for the initial PIP filing only, a proposed plan for Commission approval which establishes staff's procedural plan for monitoring the company's productivity improvement progress under the PIP.

513.10 The Commission shall review the company's plan, along with the staff report and all public comments, and make public its evaluation of the company's plan by June 1st.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5135 (November 19, 1982); as amended by Final Rulemaking published at 34 DCR 1568 (March 6, 1987); and by Final Rulemaking published at 34 DCR 5089, 4090 (June 26, 1987).

#### 514 - 519 [RESERVED]

### 520 REPORTS REQUIRED IN SECOND AND SUBSEQUENT YEARS

520.1 The company shall provide a written report by February 15th of each year that examines and explains in detail the reasons for operating performance results outside the ranges forecast in the company's prior year report concerning its annual projections of monthly fuel prices, consumption and expenditures, generating system operating performance and maintenance budget, and timetable.

520.2 In addition to this report, after the first six (6) months of data becomes available and again upon the filing of the annual PIP on February 15th, the company shall submit another report to the Commission identifying and discussing in detail the factors responsible for its progress or lack of progress toward meeting the prior year's productivity improvement objectives.

520.3 In the second year and in each year thereafter, the staff shall prepare a report for the Commission summarizing the company's operating performance over the first six (6) months under the FAC, and shall again as part of its annual PIP report do the following:

- (a) Provide an analysis of the company's progress in meeting its productivity improvement goals; and



- (b) Evaluate PEPCO's operating performance under the FAC over the previous twelve (12) months.

520.4 The staff may recommend that the particular operating performance should be investigated further by the Commission. (This recommendation would not necessarily presume that imprudent management decisions were the cause of the abnormal performance, but would suggest to the Commission that the company should thoroughly reveal the reasons for its performance to the Commission's satisfaction).

520.5 If the Commission finds that further investigation is unnecessary, the staff's request shall be denied. However, if the Commission is not satisfied with the company's explanation of its performance a further investigation (which may include an evidentiary hearing) shall be undertaken.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5135 (November 19, 1982); as amended by Final Rulemaking published at 34 DCR 1568 (March 6, 1987).

## 521 RATE CASE SCRUTINY

521.1 The company shall justify the continued use of its fuel adjustment clause in each rate filing. The burden of proof shall rest on the company to show the following:

- (a) That fuel costs are being optimized;
- (b) That generating facilities are operating at reasonable efficiency;
- (c) That fuel price and interchange cost volatility continues to be a factor supporting the continued need for a fuel adjustment clause; and
- (d) That removal of the fuel adjustment clause would adversely impact on the company's profitability and as a result lead to higher electric rates.

521.2 As a result of evidence gathered in an investigation, the Commission may order the company to modify or withdraw its fuel adjustment clause or decide to leave the existing clause unaltered. The Commission shall, in its discretion, undertake evidentiary investigations more frequently than in every rate proceeding.

SOURCE: Final Rulemaking published at 29 DCR 5130, 5139 (November 19, 1982).

## 522 MANAGEMENT AUDITS

522.1 The Commission shall periodically (but not less often than every six (6) years) have a full-scale management and operations audit of the company to determine the quality of the performance of management and identify areas for productivity to improvement.

522.2 A major purpose of the audit shall be to ensure that PEPCO's efforts to optimize fuel costs and improve its fuel-related operations are not resulting in unjustifiably higher capital equipment or other non fuel expenditures (e.g., maintenance) which offset fuel economies or improvements in generating system productivity.

522.3 The audit shall include a thorough evaluation of the company's management of the fuel procurement process. In particular, the audit shall address the following PEPCO requirements:

- (a) Planning for fuel requirements;
- (b) Internal structure and organization of personnel and how their assignment facilitates the continuing assessment of fuel prices and conditions;
- (c) Fuel source selection procedures;
- (d) Negotiation and contracting procedures;
- (e) Incentives for efficient and economical fuel procurement and utilization;
- (f) Impacts of changing environmental policies and standards on fuel procurement planning and fuel utilization;
- (g) Research efforts to ensure an effective future fuel procurement strategy;
- (h) Review of interchange arrangements; and
- (i) Strategies for identifying and developing cost-effective productivity improvement objectives.

522.4 The Commission may, in its discretion, conduct an evidentiary proceeding to consider the results and recommendations of the audit.

522.5 The company shall also submit a copy of any statutorily required annual management audit of PEPCO's fuel procurement policies and procedures. The company shall also file with the Commission copies of any other audits of its operations conducted by any regulatory body.

**SOURCE:** Final Rulemaking published at 29 DCR 5130, 5140 (November 19, 1982); as amended by Final Rulemaking published at 42 DCR 5540 (October 6, 1995).

## 523 MONTHLY REPORTS

523.1 All monthly reports under this chapter shall be filed no later than forty-five (45) days after the close of the monthly reporting period, unless otherwise specified in this chapter.

**SOURCE:** Final Rulemaking published at 29 DCR 5130, 5141 (November 19, 1982).

APPENDIX 5-1  
Definitions of Power Plant Performance Indices<sup>1</sup>

The following are definitions of performance indices to be used in complying with the Commission's FAC Audit and Review Program:

The fraction of time that a plant is available for operation is called Operating Availability (OA). This parameter is defined by:

$$OA = \frac{AH \times 100}{PH} \quad (1)$$

where

**AH** = service hours + reserve shutdown hours. **Service hours** is the number of hours a unit was in the in-service state. Reserve shutdown hours is the number of hours a unit was in the economy shutdown state, and

**PH** = the number of hours in the period measurement. A unit is not considered "available" when it is forced out of service or is down for planned maintenance. The number of **service hours** includes the number of hours that a plant operates at rated capacity and at derated capacity due to planned or unplanned partial outages. The operating availability measures the percentage of time that a unit is capable of producing power at any power level.

In order to account for the effects of partial outages in the measurement of availability, the parameter **Equivalent Availability (EA)** has been defined. This parameter is defined by:

$$EA = \frac{AH - (EFOH + ESOH) \times 100}{PH} \quad (2)$$

where

**EFOH** =  $\frac{\text{Forced Partial Outage Hours Size of Reduction in MW}}{\text{MDC}}$

**ESOH** =  $\frac{\text{Scheduled Partial Outage Hours x Size of Reduction in MW}}{\text{MDC}}$

and

<sup>1</sup>Sources:

- (1) National Regulatory Research Institute, Recommendations For Regulatory Actions To Promote Power Plant Productivity Improvements (Columbus, Ohio: NRRI, August 1979); pp. 8-11.
- (2) Institute of Electrical and Electronics Engineers, IEEE Trial-use Standard Definitions For Use In Reporting Electrical Generating Unit Reliability, Availability and Productivity (New York, New York: IEEE, December 1980).



**MDC** = Maximum dependable capacity in MW.

The equivalent availability is a measure of the unit's true ability to produce power since it takes into account partial outages. This index is important since it is possible to have a unit with one hundred percent (100%) availability but with less than one hundred percent (100%) equivalent availability. Operating availability can be used to indicate the percentage of time the unit is fully out of service. When compared to operating availability, equivalent availability can be used to indicate the additional loss in production capability due to partial outages.

The **Capacity Factor** is a measure of the actual output (MWh) of a unit within a specified time period relative to its potential output.

The **Capacity Factor** (CF) is defined by:

$$CF = \frac{\text{Total Gross Generation in MWh} \times 100}{(PH) \times (MDC)} \quad (3)$$

The "Total Gross Generation," equation (3), can be affected by factors other than forced or scheduled outages. The factors include economy dispatch and regulatory deratings. If there is no economy dispatch (base-loaded plants) and no deratings other than those due to forced or scheduled partial outages, then the capacity factor approaches the equivalent availability.

The **Heat Rate** is a measure of the thermal efficiency of a generating unit. It is defined by:

$$\text{Heat Rate (BTU/kWh)} = \frac{\text{BTU Fuel} \times (\text{Heat Input})}{\text{kWh Output}} \quad (4)$$

The **Heat Rate** represents the fuel-heat input required to generate a kWh and deliver the generated power to the transmission line leaving the station. The heat rate is inversely proportional to the unit's efficiency.

A parameter used to express a plant's total unavailability due to full forced outages (i.e., unscheduled outages) is the **Forced Outage Rate**.

This parameter is defined as:

$$FOR = \frac{FOH \times 100}{SH + FOH} \quad (5)$$

where

**FOH** = Full forced outage hours, and

**SH** = Service hours.

or

$$\text{FOF (Forced Outage Factor)} = \frac{FOH \times 100}{PH} \quad (5A)$$

where

**PH** = Period hours.

Partial forced outages are taken into account by defining an Equivalent Forced Outage Rate.

This parameter is defined as:

$$EFOR = \frac{FOH + EFOH \times 100}{FOH + SH} \quad (6)$$

or

$$EFOF \text{ (Equivalent Forced Outage Factor)} = \frac{FOH + EFOH \times 100}{PH} \quad (6A)$$

A parameter is used to express a plant's unavailability due to scheduled outages planned well in advance is the Planned Outage Rate (POR).

This parameter is defined by:

$$POR = \frac{POH \times 100}{PH} \quad (7)$$

where

POH = planned outage hours, or the numbers of hours a unit was in the planned outage state<sup>2</sup>.

A parameter used to express a plant's unavailability due to maintenance outages is the **Maintenance Outage Rate** (Class 4 outage)

This parameter is defined by:

$$MOR = \frac{MOH \times 100}{PH} \quad (8)$$

where

MOH = maintenance outage hours.

<sup>2</sup>Unplanned outage hours (UOH) are the number of hours a unit is in the unplanned outage state. IEEE identifies five (5) unplanned outage classes. These are:

Class 1 Unplanned Outage (Immediate). An outage that requires immediate removal from the available state or prevents a unit from being placed in service if off line. A starting failure shall be signed as a Class 1 unplanned outage.

Class 2 Unplanned Outage (Delayed). An outage that does not require immediate removal from the available state but requires that a unit be removed from the available state within six (6) hours.

Class 3 Unplanned Outage (Postponed). An outage that can be postponed beyond six (6) hours but requires that a unit be removed from the available state before the end of the next week-end.

Class 4 Unplanned Outage (Deferred). An outage that will allow a unit outage to be deferred beyond the end of the next week-end but which requires that a unit be removed from the available state before the next planned outage.

Class 5 Unplanned Outage (Extended). An outage that is the extension (for any reason except startup failure) of a planned outage beyond its predetermined duration.

IEEE Trial-Use Standard Definitions For Use In Reporting Electric Generating Unit Reliability, Availability, and Productivity, Institute of Electrical and Electronics Engineers; New York, New York, 1980; p.8.